

Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

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APR 16 1996

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF SECRETARY

In the Matter of

Amendment of Part 15 of the  
Commission's Rules to Permit Operation  
of Biomedical Telemetry Devices on  
VHF TV Channels 7-13 and on  
UHF TV Channels

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ET Docket No. 95-177

To: The Commission

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COMMENTS OF THE CRITICAL CARE TELEMETRY GROUP

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## SUMMARY

The Critical Care Telemetry Group (the “CCTG”), which includes virtually all manufacturers of U.S.-made low-power electrocardiogram and other medical telemetry devices, strongly supports the Commission’s objective in the instant proceeding to provide for the interference-free operation of these life-saving devices. As CCTG described in its petition for rule making, which prompted this proceeding, medical telemetry operations are now jeopardized by a lack of adequate frequencies for present use and future growth and by the risk of harmful interference on existing frequencies.

The proposals in this proceeding, if adopted, will meet the immediate needs of current users of medical telemetry devices, as well as facilitate the development of the next generation of telemetry systems. Moreover, permitting medical telemetry devices to operate, on an unlicensed basis, on vacant VHF television channels in the 174-216 MHz band (channels 7-13) and on all vacant UHF television channels at the power levels proposed by the Commission will not adversely impact either current or future television broadcast services, including advanced digital television, low power television, and low power auxiliary radio stations.

CCTG’s comments demonstrate that two to four 6 MHz TV channels are needed for biomedical telemetry in each metropolitan area. The comments — in connection with the Engineering Statement attached as Appendix A, hereto — also address the issues of frequency selectability of biomedical telemetry devices, the suitability of certain non-broadcast UHF television channels for biomedical telemetry use, maximum transmitter power limits, bandwidth, adjacent channel restrictions and out-of-band emissions, and the nature of the sites at which biomedical telemetry devices may be used.

Adoption of the rules proposed by the Commission would be consistent with the Congressional mandate that the Commission and NTIA consider carefully the spectrum requirements of telemetry operations and seek dedicated frequencies for medical telemetry. Until dedicated frequencies can be made available, however, the Commission should proceed expeditiously to permit sharing of vacant television channels, consistent with CCTG’s original Petition and with these comments.

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To: The Commission

**COMMENTS OF THE CRITICAL CARE TELEMETRY GROUP**

The Critical Care Telemetry Group (the "CCTG") hereby submits the following comments with respect to the Notice of Proposed Rulemaking ("NPRM") released in the above-captioned proceeding. CCTG consists of Hewlett-Packard Company Medical Products Group ("HP"), Marquette Electronics, Inc., Siemens Medical Systems, Inc., SpaceLabs Medical, Inc. ("SpaceLabs"), and Vitalcom (formerly Pacific Communications, Inc.). CCTG's members manufacture virtually all U.S.-made low-power electrocardiogram ("ECG") and other medical telemetry devices.

CCTG submitted the petition for rulemaking (the "Petition") that prompted the NPRM. As such, CCTG strongly endorses the Commission's proposals to amend Part 15 to expand the available frequencies and increase the authorized power for biomedical telemetry devices operating on vacant VHF and UHF television channels. CCTG commends the Commission for recognizing the importance of medical telemetry devices to the public and for acting promptly to issue the NPRM.

If adopted as a final rule, the Commission's proposal will go far to ensure that the next generation of medical telemetry devices may be developed with reasonable assurance to manufacturers and healthcare providers that these devices will be able to operate effectively with a minimum of interference over their useful lifetime. This will help protect the life and safety of patients who rely on the interference-free provision of medical telemetry services.

These comments provide an overview of the Commission's proposal in this proceeding, address the existing spectrum requirements of biomedical telemetry, and

respond specifically to a number of issues raised by the Commission in the NPRM. With respect to the latter, these comments — in connection with the Engineering Statement attached as Appendix A, hereto — address the impact of advanced digital television (“DTV”) on the instant proceeding, frequency selectability of biomedical telemetry devices, the suitability of certain special-purpose UHF television channels for biomedical telemetry use, maximum transmitter power limits, bandwidth, adjacent channel restrictions and out-of-band emissions, compatibility with LPTV and LPAS services, and the nature of the sites at which biomedical telemetry devices may be operated.

### **BACKGROUND**

Medical telemetry systems manufactured by CCTG members allow healthcare providers continuously to monitor a patient’s vital signs, including electrocardiogram (“ECG”) waveforms, while the patient is free to walk about in a limited area. Such systems allow patients who require continuous monitoring and who otherwise would be confined to bed to benefit from ambulation, thereby shortening their recovery time. These shorter hospital stays and efficient centralized monitoring made possible by telemetry systems help to contain healthcare costs.

On December 23, 1994, CCTG submitted a petition for rulemaking to the Commission requesting that biomedical telemetry devices be permitted to operate, on an unlicensed basis, on vacant VHF television channels in the 174-216 MHz band (channels 7-13) and on all vacant UHF television channels at power levels not in excess of five (5) milliwatts. The Petition was accompanied by an engineering statement that demonstrated that such use would not cause harmful interference either to existing or planned television operations (“Petition’s Engineering Statement”).

The CCTG submitted its Petition because the healthcare users of biomedical telemetry are facing a growing spectrum crisis. Despite the life-saving importance of the technology, there presently is no dedicated spectrum for medical telemetry. Medical telemetry operates on a secondary basis wherever it is found; whether on vacant VHF TV channels, the offset frequencies in the 450-470 MHz band, or in the 900 MHz ISM band. In each band, the interference-free operation of telemetry devices is imperiled.

As set forth in detail in the Petition, frequency congestion and overly restrictive power levels in the TV broadcast and ISM bands and heavy land mobile use of the 450-

470 MHz band (which could grow worse if certain proposals in the Commission's "refarming proceeding" are implemented), jeopardize the use of these frequencies for biomedical telemetry. Moreover, at the same time that existing biomedical telemetry operations are being threatened by a lack of usable spectrum, enhanced, next-generation devices requiring additional bandwidth soon will come on line. The deployment of these devices, which will meet the medical community's demand for additional telemetry patient data, will exacerbate the existing spectrum crisis.

The Congress recognized the urgent need for an interference-free home for medical telemetry, when, in connection with the passage of the Omnibus Budget Reconciliation Act of 1993, it directed both the NTIA and the Commission to consider carefully the long-range spectrum requirements of medical telemetry when allocating spectrum transferred from federal government to private sector use.<sup>1</sup> Unfortunately, all of the frequencies that were re-allocated by the federal government were above 1 GHz, which are not suitable for medical telemetry applications.

As discussed in the Petition, while a band of dedicated frequencies below 1 GHz is the only viable, long-term solution for biomedical telemetry applications, adoption of the proposals in this proceeding represents a workable, interim solution. By following through on these proposals, the Commission can accommodate the present and near-term spectrum requirements of medical telemetry without risking harmful interference to existing or planned television reception.

#### **I. Up To Four Six-MHz TV Channels May Be Required For Biomedical Telemetry In Each Major Metropolitan Area.**

The Commission seeks comment on the total amount of spectrum required to support biomedical telemetry operations.<sup>2</sup> Because medical telemetry requires continuous transmission/reception, the spectrum requirements are determined by: (1) the transmitter bandwidth, (2) the number of telemetry transmitters (*i.e.*, monitored patients) within the range of the receiver, and (3) the fraction of the designated spectrum in which interference prevents reliable telemetry operation. In light of these factors, and as discussed in detail below, CCTG believes that up to four 6 MHz

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<sup>1</sup> The Conference Report to the Budget Act notes that "biomedical telemetry systems may greatly improve the quality and significantly decrease the cost of certain health care services," and that, therefore, "NTIA and the FCC should carefully consider the needs of hospitals and other health care providers for interference-free radio spectrum in their respective allocation decisions made pursuant to this Act." See Conference Report on the Omnibus Budget Reconciliation Act of 1993, 103d Cong., 1st Sess., Rpt. No. 103-213 (1993) at 479.

<sup>2</sup> NPRM at ¶ 7.

television channels could be required in each major metropolitan area to provide an acceptable level of service to health care facility patients in need of medical telemetry devices.

Current medical telemetry systems have channel bandwidths between approximately 10 and 100 kHz. Because these systems transmit only a limited number of vital parameters, they cannot be used with patients who require extensive monitoring, but would otherwise benefit from ambulation. As noted above, since most manufacturers have increased, or are planning to increase, the number of parameters transmitted to meet this need, these devices will require additional bandwidth.

Furthermore, hospitals throughout the United States are merging and consolidating their facilities. Some large hospitals already use more than 200 telemetry channels and would use more if additional interference-free channels were available. The number of such hospitals is expected to grow. Some hospitals are projecting a need for up to 500 telemetry channels. Because medical telemetry systems are designed to operate at very low power within a single building, even hospitals located as little as one mile away from one another can safely reuse the same frequencies. This feature avoids having to consider the total number of telemetry "beds" in an entire metropolitan area in determining the number of telemetry channels needed.

Lastly, the very low power of medical telemetry transmitters and the need for continuous transmission/reception makes these systems highly susceptible to interference. If a significant number of frequencies in a telemetry band are susceptible to even intermittent interference from other users, the amount of spectrum required will increase.

For these reasons, CCTG estimates that, even at the present level of usage by large hospitals, as many as four 6 MHz TV channels may be required in each major metropolitan area (*i.e.*, 250 to 500 channels x 50 kHz average bandwidth x 100% availability / 6 MHz/TV channel = 2.1 to 4.2 TV channels).

## **II. Use Of Vacant TV Channels By Medical Telemetry Is Compatible With A Transition To DTV.**

CCTG recognizes that the transition of television broadcast operations to DTV could involve significant realignment of the presently allocated TV broadcast spectrum. It is, therefore, important to consider the effect of proposed biomedical telemetry use of this spectrum both during the transition to DTV and after it is completed.

### **A. There will be adequate spectrum during the transition to DTV.**

CCTG demonstrated in its Supplement to the Petition, filed on May 2, 1995, that adoption of the proposals set forth in the NPRM will not cause harmful interference either to existing or planned television operations and, moreover, that there would be sufficient spectrum for telemetry operations during the transition to DTV.<sup>3</sup>

In this regard, CCTG illustrated that if each broadcast licensee were granted an additional UHF TV channel during the transition to DTV, there still would be at least two (in fact four) UHF TV channels in the range of channels 20-50 (not including channel 37) available for medical telemetry in 19 of the 20 largest television markets. Along with the existing channel separation requirements for VHF broadcast TV licensees, the engineering statement attached to the Supplement demonstrated that the proposed rules would accommodate the requirements for medical telemetry during the transition to DTV. Additionally, in light of the fact that DTV transmissions are less susceptible to interference than analog television transmissions, medical telemetry operations pose no interference threat to reception of DTV.<sup>4</sup>

### **B. Ensuring adequate telemetry spectrum after the transition to DTV.**

After the transition to DTV is complete and double channel assignments for every broadcaster are no longer necessary, vacant TV channels suitable for use by medical telemetry on a secondary basis will remain. While the Commission is considering reallocating some of this spectrum to non-TV applications, it should not arbitrarily limit the availability of this spectrum for medical telemetry.

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<sup>3</sup> Supplement to Petition for Rulemaking, ET Docket No. 95-177.

<sup>4</sup> Petition's Engineering Statement at 9.



The Commission now contemplates that biomedical telemetry should vacate any TV spectrum that is reallocated to other use as a result of the implementation of DTV.<sup>5</sup> Consideration of such a proposal is premature. The Commission should not pre-judge this issue. It may well be that, given its low power and inherent shielding from in-building operation, medical telemetry could co-exist on an interference-free basis with new services operating on reallocated TV spectrum.

More importantly, in light of Congress' mandate to the Commission and NTIA to explore the allocation of dedicated frequencies to medical telemetry operations, the Commission first should consider dedicating a small amount of the former TV spectrum to the exclusive use of medical telemetry. Such a re-allocation would be consistent with Congressional intent and would advance substantially the public interest by safeguarding the interference-free operation of life-saving medical telemetry applications. Furthermore, dedicating some portion of former TV spectrum to medical telemetry technologies would allow health care providers to continue to use the devices that will be deployed following adoption of this NPRM.

### **III. The Commission Should Not Require Devices To Be Frequency Selectable.**

CCTG recognizes that the transition to DTV will create additional demand for biomedical telemetry units that can switch among frequencies. Neither manufacturers nor customers will want to replace large number of units as television channels are licensed for DTV. However, because the market will demand frequency selectability, a rule mandating a specific level of frequency selectability is unnecessary.

Notwithstanding the foregoing, if the Commission decides to impose a rule setting specific frequency selectability standards for future biomedical telemetry equipment, CCTG recommends that each individual transmitter be required to select frequencies only over a relatively narrow range, *e.g.*, 12 MHz or two 6 MHz television channels. Adjacent-channel spacing rules for broadcast television would ensure, in nearly all instances, that part of that spectrum would be available for medical telemetry.

### **IV. Non-Broadcast UHF TV Channels Are Not Adequate For Telemetry Needs.**

Several channels within the UHF television band either are currently reserved for non-broadcast use or are shared between broadcasters and land mobile users. The

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<sup>5</sup> *Id.* at ¶ 8.

Commission has requested comment on whether biomedical telemetry could operate on these channels without creating or receiving harmful interference.<sup>6</sup>

Channel 37 (608-614 MHz) currently is reserved for radio astronomy use. This channel is well-suited for use by medical telemetry on a secondary basis. If medical telemetry were authorized to use Channel 37 on a secondary basis, its low RF power levels would allow operation in all regions except those in close proximity to the few radio astronomy facilities in the United States that receive at these frequencies. As demonstrated in the attached Engineering Statement, medical telemetry devices could, consistent with the Commission's rules, be located approximately 13.0 kilometers from a radio astronomy facility and provide adequate interference protection to that facility. Since radio astronomy facilities that receive on Channel 37 frequencies are generally located in sparsely settled areas away from population centers, such a distance separation requirement would not unduly burden users of biomedical telemetry.

Accordingly, the Commission should permit operation of medical telemetry technologies on Channel 37 with the mileage separation requirement set out above. Given the need, however, for up to four 6 MHz TV channels in each metropolitan area, medical telemetry operations should not be restricted only to Channel 37. Operation of medical telemetry devices on Channel 37 in most parts of the United States would reduce by one the overall number of channels required by medical telemetry, but additional channels still must be made available.

Land mobile services in several urban areas are authorized to operate at effective radiated powers of up to 1000 watts on between one and three UHF TV channels in the 470-512 MHz band (TV channels 14-20). Assignable frequencies within these channels are spaced 25 kHz apart.<sup>7</sup> At least two members of CCTG have long-standing operations on the 12.5 kHz offset channels in the 450-470 MHz band. In large measure, they participated in the CCTG because both co-channel and adjacent channel interference from higher power land mobile users in that band have restricted the number of frequencies on which their telemetry systems can operate. As noted above, implementation of certain proposals in the "refarming proceeding" would increase the level of unacceptable interference to telemetry operations.<sup>8</sup>

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<sup>6</sup> *Id.* at ¶ 7.

<sup>7</sup> 47 C.F.R. 90.309, 90.311(a).

<sup>8</sup> PR Docket No. 92-235.

Moreover, because many transmitters in both the 450-470 and 470-512 MHz bands are mobile, it is difficult to predict which frequencies would be sufficiently interference-free to allow telemetry operation. HP and SpaceLabs have addressed these issues at length in their comments in the “refarming proceeding.” Furthermore, the 25 kHz frequency spacing in both of these UHF land mobile bands unduly limits the technology that can be used for forthcoming UHF medical telemetry systems.

The Commission also requested comment on whether biomedical telemetry may cause harmful interference with land mobile users in the 470-512 MHz band.<sup>9</sup> Because of the low power of medical telemetry devices relative to the high power of land mobile radios and in light of HP’s and SpaceLabs’ experience with telemetry systems in the 450-470 MHz band, it is unlikely that transmissions from telemetry devices would interfere with land mobile users in the 470-512 MHz band. That said, and as discussed immediately above, these frequencies are not usable for medical telemetry applications.

#### **V. CCTG Supports Use Of Radiated Emission Field Strengths.**

The original Petition’s Engineering Statement demonstrated that medical telemetry devices operating at power levels not in excess of 5 milliwatts have little or no potential to cause objectionable interference to other services. The 5 mW output power requested in the CCTG’s Petition is necessary to ensure continuous reception of the telemetry signal, which is subject to fading as a patient walks around the health care facility.

The Commission has expressed concern with basing measurements of medical telemetry devices on transmitter power, as opposed to radiated emission field strength.<sup>10</sup> In light of this concern, the Commission proposes to express the transmitter power limit in terms of an equivalent radiated field strength.

CCTG agrees with the Commission that expressing the proposed limit as 200,000 microvolts-per-meter measured at 3 meters is preferable to a limit on transmitter power output. Because the analysis of potential interference from biomedical telemetry transmitters in the Petition’s Engineering Statement assumed an effective radiated power of 10 milliwatts, that analysis is valid for the proposed 200,000 microvolts-per-meter limit, even though 5 milliwatts would correspond to a field strength of only 165,000 microvolts-per-meter.

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<sup>9</sup> NPRM at ¶7.

<sup>10</sup> *Id.* at ¶10.

The NPRM does not propose limits on antenna gain, but seeks comment as to whether such limits are appropriate.<sup>11</sup> CCTG submits that no limit on antenna gain for medical telemetry devices is needed. In most cases, ECG electrode cables attached to the patient's body serve as the antenna, which generally results in a negative antenna gain. Moreover, because the geometry of such antennae cannot be controlled in practice, specifying a maximum antenna gain would be of little practical value.

**VI. Bandwidth, Adjacent Channel Restrictions, And Out-Of-Band Emissions Requirements Must Be Tailored To Preserve Flexibility For Healthcare Telemetry Users While Preventing Harmful Interference To Other Services.**

The Commission should ensure that technical requirements for biomedical telemetry safeguard users on adjacent frequencies without unnecessarily limiting the flexibility required by telemetry users and manufacturers.

**A. LPAS**

In this regard, CCTG has been very conservative in suggesting power levels and co-channel separations and restrictions. Thus, the Commission noted in the NPRM that the co-channel separation distances CCTG suggested for medical telemetry are more restrictive than are applicable to Low Power Auxiliary Radio Stations ("LPAS"), even though medical telemetry will operate at lower power levels than permitted LPAS.<sup>12</sup> The Commission asks, therefore, whether the proposed co-channel separations are overly restrictive and, similarly, whether there is a need for any adjacent channel restrictions.<sup>13</sup> While CCTG believes that relaxing the proposed co-channel and adjacent channel restrictions would not jeopardize reception of broadcast television, it is prepared to operate within the constraints that it proposed in its Petition.

There is also a question as to the ability of medical telemetry to share spectrum with LPAS. Since LPAS is used in the production of broadcast programs and motion pictures, this issue will arise only when such production occurs in health care facilities or out-of-doors in the vicinity of health care facilities, since the shielding inherent in in-building use of LPAS would ease any sharing problem. As long as the program or film production crew is known to or nearby the health care facility, the administrator of that facility and the LPAS user can engage in real-time frequency coordination to avoid interference problems.

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<sup>11</sup> *Id.*

<sup>12</sup> *Id.* at ¶11.

<sup>13</sup> *Id.*

### **B. Emission Bandwidth**

With respect to emission bandwidth, while the Commission proposed a 200 kHz bandwidth for biomedical telemetry systems, the Commission requested comment on whether such a bandwidth was sufficient in light of the more bandwidth-intensive next generation telemetry systems.<sup>14</sup>

As set forth in the attached Engineering Statement, and as implied in the Commission's request for comment, an increase in authorized bandwidth would permit manufacturers of medical telemetry devices to include additional capabilities in second generation systems. CCTG believes that 6 MHz of bandwidth, coupled with the proposed radiated field strength limits and restricting medical telemetry to in-building use, would give manufacturers the flexibility they require without impinging on the operations of other spectrum users.

### **C. Out-of-Band Emissions**

In contrast, however, the limit for out-of-band emissions proposed by the Commission is unnecessarily stringent. The proposed limit of 150  $\mu\text{V}/\text{m}$  at 3 m would impose a 62.5 dB attenuation requirement from the allowable maximum field strength of 200,000  $\mu\text{V}/\text{m}$ . This limit is at least 35 dB more stringent than that imposed on even moderate-power LPAS stations operating on the same frequencies.<sup>15</sup>

CCTG does not propose that out-of-band emission limits should be raised to those of LPAS, which are already protective of adjacent and co-channel TV broadcast transmissions. A reasonably stringent limit should remain, primarily to reduce the potential for interference between medical telemetry systems within the same hospital. CCTG therefore proposes that the limit be raised 12.5 dB over the Commission's proposal to 630  $\mu\text{V}/\text{m}$  at 3 m.

## **VII. Telemetry Operations Can Coexist With LPTV Services.**

The NPRM seeks comment on whether the relocation of LPTV stations in response to the implementation of DTV would impede the ability of telemetry users to

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<sup>14</sup> *Id.* at ¶14.

<sup>15</sup> LPAS stations operating at 50 mW, 10 dB higher than proposed for medical telemetry, have a maximum out-of-band attenuation requirement of 35 dB. 47 CFR 74.861(e)(6). Assuming free-space propagation, the maximum allowed out-of-band field strength for those stations is 9,200  $\mu\text{V}/\text{m}$  at 3 m, which is 36 dB greater than the proposed 150  $\mu\text{V}/\text{m}$  for medical telemetry.

find usable channels in the broadcast spectrum.<sup>16</sup> The attached Engineering Statement analyzes the current use of spectrum by LPTV stations in the top three television markets in the United States.

As set forth in detail in the attached Engineering Statement, LPTV stations in these major markets do not make intensive use of available UHF channels (*i.e.*, out of the 62 channels available, only 17 are used by LPTV stations in or near New York City, 8 in the Los Angeles area, and 11 in or near Chicago). With the exception of New York City, the relocation of LPTV stations as a result of DTV will not occupy all available vacant TV channels and, therefore, prevent medical telemetry devices from operating on these frequencies. Similarly, the engineering study submitted with the Supplement to CCTG's original Petition showed that there may difficulty in finding vacant TV channels below channel 50 in San Francisco as a result of a possible DTV transition plan.

In both New York City and San Francisco, however, the attached Engineering Statement makes clear, however, that the channel availability analysis was done on a "worst case" basis assuming that LPTV stations are operating at maximum ERP and HAAT, instead of their actual operating characteristics, and without taking into account terrain, the use of directional antennae, and, in the case of San Francisco, the use of vacant channels above channel 50. By taking all these factors into consideration, CCTG's engineering consultants conclude that there will, in fact, be an adequate number of frequencies to accommodate medical telemetry in all metropolitan areas. See Engineering Statement at 6.

**VIII. The Definition Of "Healthcare Facility" Must Be Broad Enough To Ensure That The Benefits Of Telemetry Are Available To A Wide Range Of Healthcare Providers.**

The Commission proposes that the use of biomedical telemetry transmitters operating under the proposed rules be "confined to hospitals or other healthcare facilities," but requests comment on the appropriate definition of "healthcare facilities."<sup>17</sup> In proposing to permit the operation of telemetry devices at healthcare facilities, the Commission recognizes the trend in the medical community to discharge patients from hospitals to a variety of lower-level care facilities, notwithstanding the fact that many of these patients will continue to require monitoring. In light of these changes, CCTG recommends defining facilities where telemetry systems can be used

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<sup>16</sup> *Id.* at ¶12.

<sup>17</sup> *Id.* at ¶13.

based on the potential for interference, rather than assumptions about what types of facilities in the future will provide specific levels of healthcare services.

As discussed in its Petition, and reflected in the NPRM, CCTG assumed that biomedical telemetry systems would be confined to in-building use.<sup>18</sup> It was further assumed that broadcast television reception antennae subject to potential interference would be found on or in residences separate from the health care facility. Accordingly, the shielding provided by walls and floors means that medical telemetry devices can be used inside any building in which health care services requiring such devices are being provided. An entire building need not be devoted exclusively to health care for medical telemetry to be used without causing objectionable interference to TV broadcast reception.

In addition, although not licensed by the Commission, the use of medical telemetry is tightly restricted both practically and legally. Legally, the medical telemetry systems manufactured by CCTG's members are "prescription devices" that may not be sold in general commerce and whose labeling limits their use to healthcare facilities.<sup>19</sup> As a practical matter, the receivers and equipment used to monitor the incoming data from the patient transmitters are expensive systems requiring special receive antenna installation, so it would be highly unlikely for anyone to use these systems in single family residences or otherwise outside of the health care facilities for which their use is authorized by FDA-required labeling.

## CONCLUSION

The Commission's proposals in this NPRM advance the twin goals of protecting existing medical telemetry systems — which are facing increased congestion and interference — and allowing the development of improved, more efficient telemetry systems to meet the requirements of the medical profession and other healthcare professionals. Adoption of the Commission's proposal also would help protect the life and safety of patients who rely on the interference-free provision of medical telemetry services.

In the absence of dedicated spectrum for biomedical telemetry services, authorizing use of all vacant UHF and VHF television channels for medical telemetry,

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<sup>18</sup> Petition's Engineering Statement at 7.

<sup>19</sup> See 21 USC 352(f)(1); 21 CFR 801.109.

consistent with these comments, remains the best immediate option to preserve and foster medical telemetry in the face of the existing severe shortage of usable spectrum.

Respectfully submitted,

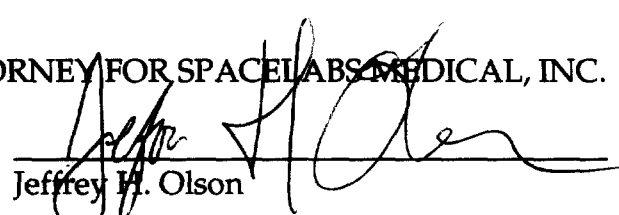
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April 16, 1996



## APPENDIX A

### ENGINEERING STATEMENT

**RUBIN, BEDNAREK & ASSOCIATES, INC.**

**COMMUNICATIONS ENGINEERING AND ECONOMICS**

**1350 CONNECTICUT AVENUE, NW - SUITE 610**

**WASHINGTON, DC 20036**

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**ENGINEERING STATEMENT**

The firm of Rubin, Bednarek & Associates ("RBA"), Inc. has been retained by the Critical Care Telemetry Group ("CCTG") to provide technical support on its behalf regarding the Federal Communications Commission's Notice of Proposed Rulemaking ("NPRM") in ET Docket 95-177. The NPRM proposes the amendment of Part 15 of the Rules to allow operation of Biomedical Telemetry Devices ("BTDs") in the frequency bands 174 - 216 MHz and 470 - 806 MHz (television channels 7 through 69) with a maximum power of 5 milliwatts.

The NPRM was requested by CCTG in its Petition for Rulemaking filed on December 1994, in which RBA provided technical support. In the petition, it was demonstrated that a BTD, operating with a maximum power of 5 milliwatts, would not cause interference to reception of the signal from television stations operating on adjacent channels. Further, by observing a number of minimum distance separation requirements, BTDs could operate on the VHF and UHF television bands without causing interference to the reception of signals from any cochannel television station using the current NTSC transmission standard or the newly proposed Digital Television ("DTV") transmission system.

On May of 1995, CCTG filed with the Commission a Supplement To Petition For Rulemaking. In the Supplement, for which RBA also provided technical support, the impact of the Commission's proposed DTV frequency allocation on the availability of the channels proposed for use by BTDs was evaluated. It was shown that by applying the minimum distance separation criteria proposed in the NPRM to existing NTSC allotments and DTV channel allotments proposed by the Commission in the top twenty television markets, at least two UHF channels would be available for use by BTDs in each city, with the exception being San Francisco.

In this Engineering Statement, RBA looked specifically at certain questions posed by the Commission. With respect to these questions, it will be shown that by including the potential reassignment of channels used by existing Low Power Television Stations (LPTV) as part of the overall reallocation of the VHF and UHF bands during the transition period to the DTV standard, there will still exist vacant channels which may be utilized by biomedical telemetry devices. It will also be

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## **ENGINEERING STATEMENT (continued)**

demonstrated that allocation of television channel 37 for use by biomedical telemetry devices will not risk harmful interference to radio astronomy. Additionally, the Engineering Statement shows that the Commission should extend the available channel bandwidth of BTDs to 6 MHz and adopt an alternative out-of-band emission limit with respect to BTDs. Finally, it is proposed herein that when operating in the near vicinity of a healthcare facility using BTDs, licensees of Low Power Auxiliary Stations ("LPAS") coordinate with the administration of the facility in selecting frequencies of operation to avoid mutual interference.

### **Sharing of Biomedical Telemetry Devices with LPTV Service**

In the NPRM, the Commission raised concerns about the interaction of BTDs with LPTV stations. Specifically, it was concerned that spectral relocation of existing LPTV stations that may occur as a result of the DTV proceeding could have a major impact on the ability of BTDs to share spectrum with the LPTV service.

In order to address this issue, the current use of the spectrum by LPTV stations in the vicinity of the three top radio/television markets in the country was analyzed. Studies were conducted for the cities of New York, Chicago and Los Angeles. Attached as Exhibits 1(a), 1(b), and 1(c) are listings of all existing and proposed low power television stations within 160 kilometers of these three cities. The bearing and distances listed in these exhibits are with respect to the following city reference coordinates used in the study :

New York, New York	:	40° 45' 06" N	73° 59' 39" W
Los Angeles, California	:	34° 03' 30" N	118° 15' 00" W
Chicago, Illinois	:	41° 53' 00" N	87° 37' 30" W

The table below lists for each city the maximum effective radiated power (ERP) and antenna height above average terrain (HAAT) of the LPTV stations listed in Exhibit 1.

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**ENGINEERING STATEMENT (continued)**

**Table 1: Maximum LPTV ERP and HAAT In Top Three U.S. Markets**

	<u>New York</u>	<u>Los Angeles</u>	<u>Chicago</u>
Maximum ERP (channel 7-13)	0.72 kW	0.003 kW	0.41 kW
Maximum HAAT (channels 7-13)	227 meters	-277 meters	361 meters
Maximum ERP (channel 14-69)	129 kW	43.7 kW	119 kW
Maximum HAAT (channels 14-69)	423 meters	1194 meters	476 meters

For the purposes of analysis, it can be assumed that, for each city, all LPTV stations operate nondirectionally with the above-listed maximum ERP and HAAT values at their corresponding operating channel. Such an assumption could be considered a worst-case coverage environment in each city which would be faced by operators of BTDs.

From Section 74.707 of the Rules the protected coverage contours for LPTV stations are as follows :

**Table 2 : Protected LPTV Coverage Contours**

<u>Channel</u>	<u>Protected Contour</u>
7 through 13	68 dBu
14 through 69	74 dBu

Using the F(50,50) signal propagation curves shown in Figures 10 and 10(b) of Section 73.699, the distance to the LPTV protected contour was determined at each city for theoretical LPTV facilities operating with the maximum ERP and HAAT values listed above, in accordance with the methodology contained in Section 73.684 of the Rules. These distances are listed in the table below :

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## ENGINEERING STATEMENT (continued)

**Table 3: Distance To Protected LPTV Contours For Top Three Cities**

	Operating <u>Channel</u>	Protected Contour <u>(dBu)</u>	ERP <u>(kW)</u>	HAAT <u>(meters)</u>	Distance To Protected Contour <u>(km)</u>
New York	7 - 13	68	0.72	227	19.3
	14 - 69	74	129	423	46.0
Los Angeles	7 - 13	68	0.003	-277	1.7
	14 - 69	74	43.7	1194	53.6
Chicago	7 - 13	68	0.41	361	21.4
	14 - 69	74	119	476	47.4

In the NPRM, the Commission has proposed that biomedical telemetry units operate in a manner such that the generated field strength does not exceed 200,000  $\mu\text{V/m}$  at a distance of 3 meters. The standard equation for field strength in free space is :

$$E = \frac{\sqrt{(30)(ERP)(1.64)}}{d} \quad (\text{see footnote } ^1)$$

Where :

- $E$  : Field Strength (Volts/meter)
- $ERP$  : Effective Radiated Power Relative To A Dipole Antenna (Watts)
- $d$  : Distance (meters)

Using this equation, the corresponding ERP from a BTM that would be required to generate a field strength of 200,000  $\mu\text{V/m}$  at 3 meters is 7.3 milliwatts.

<sup>1</sup> "Engineering Handbook, seventh edition", National Association of Broadcasters (1985), p. 2.9-238, equation 9.

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## **ENGINEERING STATEMENT (continued)**

In its original filing with the FCC, CCTG had specified an undesired-to-desired cochannel signal protection ratio of -45 dB. This value is the same as that specified in Section 74.707 of the Rules concerning protection of cochannel LPTV stations. Applying this ratio to the above-specified LPTV facilities, a minimum-distance separation requirement between BTDs and nearby cochannel LPTV facilities may be obtained. These separations are listed in Exhibit 2. Only LPTV stations that are separated from a BTB unit by distances less than or equal to those listed in Exhibit 2 would be considered to possibly restrict the operation of the BTBs. Adjacent-channel interference was not considered in this study since, as detailed more fully in CCTG's original filing, the distance to the predicted interfering contour of a BTB is extremely small, making this type of interference insignificant. It should be noted that in determining the distance to the interfering contours produced by BTBs, F(50,50) curves shown in Figures 10 and 10a of Section 73.699 of the Rules were employed. Further, it was assumed that a BTB operated with a maximum ERP of 0.0073 Watt at an antenna height of 30.5 meters above average terrain.

Applying the above separation criteria to the stations listed in Exhibits 1(a) through 1(c), it can be seen that out of a total pool of 62 available television channels (7 through 69), there are 17 channels being utilized by LPTV stations in or near New York, 8 channels in the Los Angeles area and 11 channels utilized in or near the vicinity of Chicago that could potentially impact the operation of BTBs.

In determining the available channels that could be utilized by BTBs, channels currently used by existing full service television stations as well as those tentatively assigned for use by DTV stations in FCC Docket 87-268 must be included in the analysis. In the NPRM, it is proposed that BTBs be separated from VHF stations operating in zone 1 by 107.1 kilometers and those operating in zones 2 and 3 by 131.8 kilometers. The minimum separation requirement, proposed in the NPRM, between a BTB and a UHF television station operating in zones 1, 2 or 3 is 113.2 kilometers. The attached Exhibits 4(a) through 4(c) are tabulations of both NTSC and DTV channel assignments within 113.2 kilometers of the reference site of New York and Chicago, which are located in zone 1, and 131.8 kilometers of Los Angeles, located in zone 2. For each city, the unused UHF channel assignments are

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**ENGINEERING STATEMENT (continued)**

listed in Exhibit 5. As can be seen from this exhibit, there are 15 unused channels in New York, 13 in Los Angeles and 28 in Chicago.

If it is assumed that as a result of the DTV proceeding in Docket 87-269, every channel assigned to an LPTV facility located within the separation distance listed in Exhibit 2 for each of the three cities is reassigned to one of the unused channel assignments listed in Exhibit 5, then in New York there will be no channels available for use by BTDS, 5 channels will be available in Los Angeles and 17 channels will be available in Chicago.

From the above analysis, it is evident that there are communities such as New York in which the spectrum is so heavily used that it may be difficult to identify a vacant channel which BTDS may utilize. However, based on the limited study undertaken in this report, it would be reasonable to assume that for most communities, where television frequencies are not as intensively used as in New York, there will in all likelihood be channels available which could be utilized by BTDS.

It should be emphasized that the analysis undertaken in this study is "worst case". All LPTV stations were assumed to be operating nondirectionally with a maximum ERP and HAAT combination in excess of those employed by any existing or proposed station in the regions studied. No attempt was made to take into account the effect of the intervening terrain on the coverage of the LPTV stations. Furthermore, the actual operating characteristics of each station were not considered. Generally, most LPTV stations employ directional antennas which further limit their coverage. By taking all of these factors into consideration, it is very likely that in all metropolitan areas, there will be channels available for use by biomedical telemetry devices.

As a final note, in its Supplement To Petition For Rulemaking, CCTG indicated that as a result of the DTV proceeding no channels would be available for use by BTDS in San Francisco. However, it should be pointed out that in the supplement only UHF channels 20 through 50 were considered. No attempt was made to ascertain

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**ENGINEERING STATEMENT (continued)**

the availability of frequencies in the television channels 7 through 19 or 51 through 69 (as was done for the this study).

**Out-of-Band Emissions**

In the NPRM, the Commission has proposed that the field strength of emissions radiated by a biomedical telemetry device outside of its operating bandwidth not exceed 150  $\mu\text{V/m}$  (43.5 dBu) at a distance of 3 meters. A BTD device operating in such a manner so as to generate an in-band signal strength of 200,000  $\mu\text{V/m}$  (106 dBu) at a distance of 3 meters would be required to attenuate its out-of-band emissions by more than 62 dB. CCTG believes that this level of attenuation is overly-stringent and would be very difficult to implement.

Under Section 73.687 of the Rules, the out-of-band emission requirements for a full power television broadcast facility are as follows:

	<b><u>Required Attenuation</u></b>
Frequencies below the lower band edge	>20 dB <sup>2</sup>
Frequencies above the upper band edge	>20 dB <sup>2</sup>
Frequencies 3 MHz or more above the upper band edge	>60 dB <sup>3</sup>
Frequencies 3 MHz or more below the lower band edge	>60 dB <sup>3</sup>

Under Section 74.736(c)(1) of the Rules, the out-of-band limits for an LPTV facility are :

	<b><u>Required Attenuation</u></b> <sup>3,4</sup>
Frequencies 3 MHz or more above the upper band edge	>30 dB
Frequencies 3 MHz or more below the lower band edge	>30 dB

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<sup>2</sup>Specification contained in Section 73.687(a) of the Rules. Measured in accordance with the procedures contained in Section 73.687(a)(2) of the Rules.

<sup>3</sup> Relative to visual transmitted power.

<sup>4</sup> Specification applies to transmitters rated at no more than one watt power output.



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**ENGINEERING STATEMENT (continued)**

Under Section 74.861(e)(6) of the Rules, the out-of-band limits for a Low Power Auxiliary Station operating at UHF frequencies are :

	<u>Required Attenuation<sup>5</sup></u>
Any frequency removed from operating frequency by 50% to 100 % of the operating bandwidth	>25 dB
Any frequency removed from operating frequency by 100% to 250 % of the operating bandwidth	>35 dB
Any frequency removed from operating frequency by more than 250 % of the operating bandwidth	>43+Log <sub>10</sub> (mean output power) dB

As evident from the above table, the out-of-band emission limits being proposed for BTDs are more stringent than those specified for full power television stations. Given that under the NPRM, biomedical telemetry devices would operate with a maximum transmitter output power level of 5 milliwatts, a level that is far less than those permitted for full power and LPTV stations as well as Low Power Auxiliary Stations, the proposed out-of-band emissions criteria are overly restrictive.

CCTG states that the field strength of emissions radiated by a biomedical telemetry device on frequencies outside of its operating band should be no greater than 630  $\mu\text{V/m}$  (56 dBu) measured at 3 meters from the unit. These out-of-band emission limits would be 50 dB below the proposed in-band field strength level of 200,000  $\mu\text{V/m}$  (106 dBu).

Although the out-of-band emissions are less stringent than those specified for full service and low power television stations, they are more so when compared to LPAS stations which are permitted to operate with a maximum power of 250 milliwatts at UHF frequencies. Further, CCTG's suggested out-of-band emission limits provide protection to BTDs, made by various manufacturers, from other BTDs operating on adjacent channels and operating in the same general area.

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<sup>5</sup> Relative to mean output power.